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VIRTUAL SHOW AREA AT NOMINAL SCALE

This invention relates to a process for making a virtual show area at nominal scale. It also relates to a virtual show area, and particularly a virtual shop, at nominal scale.

Large distribution companies carry out studies in order to calculate the chances of success of their new products. Tests carried out include tests in shops. "Artificial" supermarkets are thus formed comprising different departments, some of which contain the new products to be tested. Consumers are invited to do their shopping from a list of products. Their choices and their behaviours are analysed while they are doing their shopping and subsequently in an individual interview. The results are used mainly to study the impact of the outside appearance of the product (packaging) and to predict future sales of the new product.

It was proposed to replace the "artificial" shop by a virtual experimental shop, making a supermarket as realistically as possible using new projection and immersion techniques recently developed in the virtual reality field.

The problem that arises is to make a virtual shop enabling the person to do his or her shopping naturally

in the same way as in a supermarket. The shopper must be able to move between departments, stop in front of the department in which he or she is interested, choose a product, handle it and put it in the shopping basket.

More generally, the problem that arises is to make a virtual show area (for example an art gallery) and offer the visitor the possibility of moving around as he or she wishes and to handle objects, animals and plants in it.

This is the objective of this invention.

According to the invention, the process for making a virtual show area, and particularly a shop, in which the user is immersed in an environment corresponding to the environment of a real show area, particularly concerning the dimensions, distances and field of vision, comprises the following steps.

The process comprises a step in which the basic image representing a display case at the nominal scale, particularly shelves, is broken down into a predetermined number of precalculated sub-images.

The process according to the invention also includes the step in which the precalculated sub-images are projected without overlap onto a screen using several video projectors. The expression "without overlap" means that the sub-images do not overlap. This technique means that relatively economic video projectors (low equipment and installation cost) can be used without reducing the quality of the projected image, provided that appropriate measures described below are applied according to the invention. Advantageously, there are six video projectors.

The process according to the invention also comprises a step in which the said video projectors are synchronized by means of at least one personal computer. Advantageously, three personal computers are used in the network. Thus, the high-resolution image composed of

sub-images projected by video projectors synchronized by the computers, forms a virtual display case at nominal scale.

The process according to the invention also comprises steps in which:

- a graphic model of one of the objects presented on the display case is created in three dimensions,
- the said virtual object can be manipulated by means of a user-virtual display case interface.

Thus, as in a real show area, the user can pick up the 3D representation of the virtual object on the display case, move it and turn it in all directions while keeping the display case within his field of vision in the background at nominal scale alongside the other objects presented on it.

Preferably, a single modelled 3D object is manipulated during the manipulation phase in order to reduce the necessary calculation power, without reducing the realism of the virtual show area.

Advantageously, a modelled 3D object is manipulated by sensing the movements of the user's hand(s) by means of a three dimensional positioning sensor with six degrees of freedom, connected to the user - virtual display case interface. In particular, the said user - virtual display case interface is in the form of a trolley with the same characteristics as the trolleys used in real shops. Also advantageously, the three-dimensional positioning sensor is in the form of a manipulable object, particularly a parallelepiped or a ball that the user holds in his or her hand(s).

Preferably, the user - virtual display case interface comprises control means that the user can use to indicate the display case on which the object(s) that he or she wants to see and/or manipulate are located. In this case, the process according to the invention

also comprises the step in which images projected onto the screen are changed as a function of information provided by the user. Thus, the process can simulate a movement of the user in the show area.

Advantageously, the control means comprise position and/or orientation sensors, particularly located on the trolley. In this case, the process according to the invention also comprises a step in which the user's position and/or orientation relative to the virtual display case can be changed as a function of information supplied by the sensors.

This invention also relates to a virtual show area, particularly a virtual shop at nominal scale such that the user is immersed in an environment corresponding to the environment of a real show area, particularly concerning the dimensions, distances and field of vision.

The virtual show area comprises first calculation means to breakdown the basic image representing a display case at nominal scale, particularly shelves, into a predetermined number of precalculated sub-images. The virtual show area also comprises several video projectors, advantageously six, designed to project the precalculated sub-images onto a screen without overlap. The virtual show area also comprises synchronization means to synchronize the said video projectors using one or several (advantageously three) networked personal computers. Thus, the high-resolution image composed of sub-images projected by the video projectors synchronized by the computers, forms a virtual display case with the real dimensions of a display case.

The virtual show area also comprises:

- second calculation means for calculating a graphic model of one of the objects displayed on the display case, in three dimensions,

- a user - virtual display case interface comprising manipulation means for virtually manipulating the said object.

Thus, as in a real show area, the user can pick up the 3D representation of the virtual object on the display case, move it and rotate it in all directions while the display case and other objects presented with the display case remain in the background within his field of vision at nominal scale.

Preferably, the manipulation means can only manipulate one modelled 3D object during the manipulation phase, in order to reduce the necessary calculation power without reducing the realism of the virtual show area.

Also preferably, the user - virtual display case interface comprises a three-dimensional positioning sensor with six degrees of freedom, in order to pick up the movements of the user's hand(s) and to manipulate modelled 3D object. Advantageously, the user - virtual display case interface is in the form of a trolley with the same characteristics as trolleys used in show areas and shops. Also advantageously, the three-dimensional positioning sensor is in the form of a manipulable object, particularly a parallelepiped or a ball that the user holds in his or her hand(s).

Preferably, the user - virtual display case interface comprises control means that the user can use to indicate the display case on which the object(s) that he or she wants to see and/or manipulate are located. In this case, the virtual show area comprises third calculation means for changing the images projected on the screen as a function of the information supplied by the user. Thus, the sub-images projected on the screen simulate displacements of the user in the show area. Advantageously, control means include position and/or

orientation sensors, particularly located on the trolley.

Other characteristics and advantages of the invention will become obvious after reading the description of variant embodiments of the invention given as non-restrictive examples for information, and:

- figure 1 that contains a diagrammatic perspective view of a variant embodiment of the system according to the invention, for the case of a virtual shop,

- figure 2 that shows the reconstituted image of a display case as it appears on the screen described with reference to figure 1.

We will now describe a variant embodiment of the system according to the invention for the case of virtual shop, with reference to figures 1 and 2.

The virtual shop 1 comprises first calculation means 7 for breaking down the basic image 20 representing a display case at nominal scale, and particularly shelves 21, into a predetermined number of precalculated sub-images. Much greater levels of detail are possible with precalculated images than would be possible with an image calculated in real time. Thus, it becomes possible to project shadows, calculate reflections, details of the background. In the case of the variant embodiment described, the basic image 20 is broken down into six sub-images 20a, 20b, 20c, 20d, 20e and 20f. Six video projectors 8a, 8b, 8c, 8d, 8e and 8f operate in cooperation to project the precalculated sub-images 20a, 20b, 20c, 20d, 20e and 20f onto a screen 9 located at a distance of a few meters. All the sub-images form a high-resolution image with the real dimensions of a display case 20.

The display characteristics of the image 20 on the screen 9 are determined based on the normal distance of the person looking at the shelves in a shop. This

distance is one meter. The visual separation power is also taken into consideration; for an emmetropic eye, this value is an angle of 2' for two black points on a light background. A 4 m long by 2 m high very high resolution image can be obtained by combining six video projectors each with a resolution of 1024 x 768 pixels or 1280 x 1024 pixels, resulting in 3072 x 1536 pixels for XGA type video projectors or 3840 x 2048 pixels for SXGA type video projectors. Thus, the user 2 is immersed in an environment corresponding to the environment of a display case in a real shop, particularly concerning the length 3 (4 m) and the height 4 (2 m), the distance 5 from the display case (1 m), and the field of vision 6.

The virtual shop comprises synchronization means 10 to synchronize the said video projectors 8a, 8b, 8c, 8d, 8e and 8f by means of three networked PC compatible personal computers 10a, 10b, 10c. These three computers are connected to the video projectors by wire links 11a, 11b, 11c, 12a, 12b and 12c, using either three PCs with two video outputs or two PCs with three video outputs. The three PCs 10a, 10b and 10c are also connected 18, 19 to calculation means 7 or comprise calculation means 7 that have the role of precalculating the images 20a, 20b, 20c, 20d, 20e and 20f.

The virtual shop also comprises second calculation means 13 for calculating a graphic 3D model, in three dimensions, (in a manner known in itself), of one of the objects 22 presented on the display case 20. In the example embodiment shown, this calculation means 13 are separate from the other calculation means. In other variant embodiments, they form part of the synchronization means 10. They are connected 18, 19 through PCs 10a, 10b, 10c to video projectors 8a, 8b, 8c, 8d, 8e and 8f. Thus it is possible to project the image of the calculated 3D objects on the screen 9. The

virtual shop shall also comprise a user - virtual display case interface in the form of a trolley 14 like that used by shoppers in supermarkets. The interface 14 comprises manipulation means 15 for virtually manipulating the said object 22. These manipulation means 15 comprise a three-dimensional positioning sensor with six degrees of freedom in the form of a ball that the user 2 holds in his or her hand. The manipulation means are interconnected 17, 18 to the 3D object calculation means 13. It is thus possible to sense the movements of the hand of the user 2 and manipulate a modelled 3D object 22. Thus, as in a real shop, the user can pick up the 3D representation of the product 22 that he is considering purchasing, on the display case. He or she can also move it and rotate it in all directions to read the information printed on the packaging. He or she can then put it in the trolley, if required. During these operations, the user retains the display case 20 in his or her field of vision, with all the other objects 23 presented on it. In the case of the variant embodiment described, the calculation means 13 and the manipulation means 15 are designed so that only one modelled 3D object 22 can be manipulated during the manipulation phase, to reduce the necessary calculating power without reducing the realism of the virtual show area. Photographic quality could be used for these synthesized images. Since the calculation means are no longer being used to calculate the background scenes, the entire calculation power is released to manipulate the product in the foreground. Speeds of 25 to 30 images per second are possible.

The virtual shop 1 can also be used to simulate the entire shop and the behaviour of a consumer moving around in alleys searching for a display case containing the products that he or she is looking for. Consequently, the trolley 14 includes control means 16

that the user 2 can use to indicate the direction in which he or she wants to go and the display case in which the objects that he or she wants to see and/or manipulate are located. In the variant embodiment described, the control means 16 comprise position and/or orientation sensors. Conventionally, the user applies pressure on these control means 16 similar to the pressure that a person would normally apply on the handle of the trolley. The virtual shop comprises third calculation means 17, 17b and 17c associated with the PCs 10a, 10b and 10c and the video projectors 8a, 8b, 8c, 8d, 8e and 8f, to make the simulation. These calculation means 17a, 17b, 17c are interconnected to the control means 16. They recalculate the images 20a, 20b, 20c, 20d, 20e, 20f projected on the screen 9 in real time as a function of the information supplied by the user 2 actuating the control means 16. Therefore screen 9 simulates relative movement of the user 2 in the shop 1 or the user turning around relative to the display case in front of which he or she is located. In practice, the trolley 14 remains in the same place or is moved slightly by being oriented differently in front of screen 9.